

## Earth's Atmosphere and Weather

**6-4 The student will demonstrate an understanding of the relationship between Earth's atmospheric properties and processes and its weather and climate. (Earth Science)**

**6.4.7 Explain how solar energy affects Earth's atmosphere and surface (land and water).**

**Taxonomy level:** 2.7-B Understand Conceptual Knowledge

**Previous/Future knowledge:** This indicator contains new conceptual material. It can be reinforced with concepts in standard 6-5 where solar energy sources and properties are identified (6-5.1), where energy transformation is explained (6-5.2) and where heat energy transfer is illustrated (6-5.5). In high school Earth Science students will further study the effects human activities have had on the atmosphere due to excess greenhouse gases, ozone depletion, and photochemical smog (ES-4.7)

**It is essential for students to know** that the driving energy source for heating of Earth and circulation in Earth's atmosphere comes from the Sun and is known as *solar energy*. Some of the Sun's energy coming through Earth's atmosphere is reflected or absorbed by gases and/or clouds in the atmosphere.

- The land heats up and releases its heat fairly quickly, but water needs to absorb lots of solar energy to warm up. This property of water allows it to warm more slowly but also to release the heat energy more slowly. It is the water on Earth that helps to regulate the temperature range of Earth's atmosphere.
- Solar energy that is absorbed by Earth's land and water surfaces is changed to heat that moves/radiates back into the atmosphere (troposphere) where the heat cannot be transmitted through the atmosphere so it is trapped, a process known as the *greenhouse effect*.

**It is not essential for students to know** the electromagnetic spectrum as part of solar (radiant) energy. Students do not have to explain the greenhouse effect in its negative terms based on excess greenhouse gases in the atmosphere.

### Assessment Guidelines:

The objective of this indicator is to *explain* how solar energy affects Earth's atmosphere and surface (land and water); therefore, the primary focus of assessment should be to construct a cause-and-effect model of solar energy's impact on Earth's atmosphere and on the land and water surfaces. However, appropriate assessments should also require students to *summarize* the process known as the greenhouse effect; or *identify* factors in the atmosphere that would either reflect or absorb solar energy.